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— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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17 March 2005

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: OXIDATION PROCESS FOR THE PRODUCTION OF CARBOXYLIC ACIDS AND ALKENES

(57) Abstract: An oxidation process for the production of alkenes and carboxylic acids from a feed comprising alkene and/or alkane, carbon monoxide, a molecular oxygen containing gas and optionally water in the presence of an oxidation catalyst in which the level of carbon monoxide is maintained between 1% and 20% by volume of the total feed to the reactor.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER	
IPC 7	C07C51/215 C07C51/25 C07C67/05 C07C67/035 C07C53/08
	C07C69/01 C07C69/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/90043 A (ZEYSS SABINE ; AVENTIS RES & TECH GMBH & CO (DE); DINGERDISSEN UWE (DE) 29 November 2001 (2001-11-29) *the whole document; in particular, page 7, last paragraph; page 8, last paragraph; page 9, first paragraph; page 11, last paragraph; page 13, last paragraph and the tables*	1,2,4-9, 13,16-33
Y	----- WO 01/90042 A (ZEYSS SABINE ; AVENTIS RES & TECH GMBH & CO (DE); DINGERDISSEN UWE (DE) 29 November 2001 (2001-11-29) *the whole document; in particular, page 5, last paragraph; page 9, lines 20-25 and the tables*	3,10-12, 14,15
X	-----	1,2,4-9, 13,16-33
Y	-----	3,10-12, 14,15
	-/-	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the International filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

national application No.
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Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1,2,4-22(part),23,24-33(part)

Process for the oxidation of a C₂ to C₄ alkane to produce the corresponding alkene and carboxylic acid and/or for the oxidation of a C₂ to C₄ alkene to produce the corresponding carboxylic acid, the process comprising feeding to an oxidation reaction zone said alkane and/or alkene, a molecular oxygen-containing gas, carbon monoxide and optionally water, in the presence of a catalyst to produce a first product stream containing alkene and carboxylic acid, characterised in that said carbon monoxide is maintained at between 1% and 20% by volume of the total feed to the oxidation reaction zone and possibly further comprising contacting in a second reaction zone at least a portion of said alkene and at least a portion of said carboxylic acid obtained from the oxidation reaction zone and a molecular oxygen-containing gas, in the presence of a catalyst to produce a second product stream comprising alkenyl carboxylate.

2. claims: 3,4-22(part),24-33(part)

Process for the oxidation of a C₂ to C₄ alkane to produce the corresponding alkene and carboxylic acid and/or for the oxidation of a C₂ to C₄ alkene to produce the corresponding carboxylic acid, the process comprising feeding to an oxidation reaction zone said alkane and/or alkene, a molecular oxygen-containing gas, carbon monoxide and optionally water, in the presence of a catalyst to produce a first product stream containing alkene and carboxylic acid, characterised in that said carbon monoxide is maintained at between 1% and 20% by volume of the total feed to the oxidation reaction zone and possibly further comprising contacting in a second reaction zone at least a portion of said alkene and at least a portion of said carboxylic acid obtained from the oxidation reaction zone and a molecular oxygen-containing gas, in the presence of a catalyst to produce a second product stream comprising alkyl carboxylate.

INTERNATIONAL SEARCH REPORT

In International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 156 928 A (KHAN ASAD ET AL) 5 December 2000 (2000-12-05)	1, 4-8, 13, 16-21, 24-28, 30-33
Y	*the whole document; in particular, column 2, lines 57-64; column 3, lines 7-11 and 51-56; column 6, lines 16-28 and table 2*	3, 9-12, 14, 15, 22
X	US 6 143 921 A (KARIM KHALID ET AL) 7 November 2000 (2000-11-07)	1, 2, 4-9, 13, 16-33
Y	*the whole document; in particular, column 4, lines 26-31; column 5, lines 20-23 and 37-41; example 3 and the claims*	3, 10-12, 14, 15
Y	EP 1 201 631 A (BP CHEM INT LTD) 2 May 2002 (2002-05-02) *the whole document, in particular, paragraphs 38, 47, 48, 54, 57, 69, 79 and tables II, IV and V*	1-33
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Y	US 6 040 474 A (WATSON DERRICK JOHN ET AL) 21 March 2000 (2000-03-21) the whole document	1-33
P,X	US 6 670 504 B1 (ROESKY RANIER ET AL) 30 December 2003 (2003-12-30) *the whole document; in particular, column 3, last paragraph and column 4, first paragraph and lines 31-53*	1-33

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